EXERCISE DEVICE FOR EXERCISING UPPER BODY SIMULTANEOUSLY WITH LOWER BODY EXERCISE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Patent Application Serial Number 10/033,108, filed December 28, 2001, which claims priority from U.S. Provisional Patent Application Serial Number 60/259,293, filed on December 29, 2000, both of which are incorporated herein by reference. This application also claims priority from U.S. Provisional Patent Application Serial Number 60/463,534, filed on April 17, 2003, incorporated herein by reference.

TECHNICAL FIELD

This invention relates to exercise machines, and more particularly to treadmills having an upper body exercise component for providing total-body exercise.

BACKGROUND OF THE INVENTION

The exercise and fitness industry continues to be an area of high growth, marked by a proliferation of exercise machines. Among many of the most popular exercise machines are aerobic leg exercise machines, such as but not limited to: treadmills, air walkers/gliders, upright and recumbent bicycle machines, torso-twisting disks, cross-trainers, steppers, elliptical exercise machines, cross-country and downhill ski machines, trampolines, squat machines, rowing machines, stretching machines, abdominal machines and the like.

Many exercise machines have some sort of handrail, grip, or handlebars for resting the arms, while other embodiments provide nothing to hold on to, and still other embodiments have some type of mechanism to enable simultaneous exercising of the arms and/or upper body. Such mechanisms may include but are not limited to poles, shafts, or arms that, for example, move back and forth. Machines with such mechanisms for exercising both the legs or lower body and arms or upper body are often referred to as "dual action" or "total body" exercise machines.

Dual action or total body machines have a number of benefits, including offering a more complete total body exercise that includes both the arms and/or the upper as well as the lower body. The increased work raises the user's metabolism and heart rates more quickly than single action machines, and maintains the higher metabolism and heart rate throughout the workout. Such machines are therefore more efficient, providing more exercise in less time. The arm exercise features also strengthen, tone, or shape the arm muscles during the aerobic workout. The overall safety of machines with such features is also typically enhanced, as the arm exercise mechanisms typically provide improved balance to the user as compared to embodiments without such mechanisms.

There are, however, a number of disadvantages inherent in presently available dual action machines. Typically, the upper body or arm motion provided by such machines is an unnatural motion, requiring the user to push forward and/or pull backward. For example, certain cross-country ski machines, have a cable or reel system for the arms that is mounted at chest level in front of the user. The front-mounted arm system produces an awkward, pull-down/backward motion on the backswing of the arms. This causes the body to lean so uncomfortably forward that a separate structure is typically provided as a stomach/mid-section support.

Additionally, arm-exercise mechanisms, such as poles, on existing machines typically require the user's arms to be raised above the waist during the entire push/pull cycle. The poles or exercise arms are generally mounted in a fixed position, in front of the user, often making the user lean forward, straining the lower back and neck, rather than being in a more comfortable, upright posture position. Additionally, the poles or exercise arms typically travel in a fixed arc in a single plane, thus limiting the range of motion of the arms and upper body to a predetermined distance traveled and to a single plane of motion that is unnatural.

The poles or arms may often be dependent on or tied into the motion of the leg exercise device. This limits the motion of the arms or upper body to the motion of the legs or lower body, typically in a one-for-one cycle. Poles that are dependent upon the leg motion typically keep moving, even when not engaged by the

exerciser. This creates the safety risk of striking the user. Also, because the poles or exercise arms keep moving and do not fold away, the user is basically forced to use them and has no choice of exercising in a non-dual-action, arms-free mode because the poles interfere with a natural arm swing. In many machines, the arms or poles do not fold away or fold down flat for more compact storage.

Arm exercise poles and many other arm-exercise devices currently available typically must be held in a closed grip fashion by the hands, which may cause fatigue, strain or cramping of the hand, wrist, and/or arm. A closed grip may also have the undesirable effect of raising blood pressure. Additionally, the act of pushing a pole forward may put considerable pressure on the palm of the hand, causing a discomfort in a sensitive pressure point.

In summary, many current dual action exercise machines typically require arm motion that may be unnatural and/or uncomfortable, and in some circumstances, that may be unsafe. Additionally, the various arm exercise mechanisms known in the art are often relatively expensive.

It is particularly desirable, therefore, to provide a source of resistance behind a user of an exercise machine that allows the user's arm to perform a forward swinging motion in a natural, free-swinging arm position while providing adequate resistance to that motion to facilitate an upper body workout. It is also advantageous to provide structures for affixing such an exercise device to a treadmill or other lower body exercise machine to provide resistance behind the user.

SUMMARY OF THE INVENTION

One aspect of the invention is an exercise device for exercising the upper body simultaneously with lower body exercise. The exercise device comprises a lower body exercise machine; an upper body exercise module attached to the lower body exercise machine, and a mounting device on which the upper body exercise module is mounted for attachment to the lower body exercise machine. The upper body exercise module comprises an elongated connector having first and second ends, a user engagement connected to the elongated connector first end for engaging a

body appendage of a user; and a resistance mechanism for resisting a tensile force applied to the first end of the elongated connector. The mounting device comprises a mounting arm adapted to position the upper body exercise module behind and to one side of the user when the user is in a normal use position on the lower body exercise machine. The resistance device is adapted to provide resistance to a full natural arm swing of the user. The mounting arm is positioned to avoid interference with an egress path directly behind the user in the normal use position on the lower body exercise machine.

In one embodiment, one upper body exercise module is mounted on a left side of the machine and one upper body exercise module mounted on a right side of the machine. The mounting arm for the left side of the machine is preferably not attached to the mounting arm for the left side of the machine.

The lower body exercise device may be a treadmill or an air walker/glider, upright or recumbent bicycle machine, torso-twisting disk, cross-trainer, stepper, elliptical exercise machine, cross-country or downhill ski machine, trampoline, squat machine, rowing machine, stretching machine, or abdominal machine.

The mounting device may be movable from a use position to a non-use position, or fixed in a single position. The mounting device may, for example, be pivotable in a horizontal or vertical plane or slidable from the use position to the non-use position and may be adjustable to a plurality of use positions, including having a mechanism for adjusting the height of the upper body exercise device relative to the exercise machine. The mounting device may be adapted to fasten to a side or to the foot of the lower body exercise machine.

In one embodiment, the mounting device comprises a mounting bar and an extension arm attached to the mounting bar, the mounting bar adapted to fasten to a foot of the exercise machine through a hole in the foot of the exercise machine. In such an embodiment, the extension arm may comprise a lower portion, an upper portion, and an angle (a) between the upper portion and the lower portion, the angle (a) comprising an angle in the range of 90° to 180°. In this embodiment, the

mounting device may also be adapted to fasten to the foot of the exercise machine such that the extension arm creates an angle (b) to a horizontal plane, the angle (b) comprising an angle in the range of 0° to 90°.

The lower body exercise machine may be adapted to allow a full, natural arm swing of the user without the user's arm hitting any portion of the lower body exercise machine or attachment to the lower body exercise machine.

Another aspect of the invention comprises an upper body exercise device for attaching to a lower body exercise machine to allow exercising the upper body simultaneously with lower body exercise. The upper body exercise device comprising an upper body exercise module and a mounting device on which the upper body exercise module is mounted for attachment to the lower body exercise machine. The upper body exercise module comprises an elongated connector having first and second ends, a user engagement connected to the elongated connector first end for engaging a body appendage of a user, and a resistance mechanism for resisting a tensile force applied to the first end of the elongated connector. The mounting device comprises a mounting arm adapted to position the upper body exercise device behind and to one side of the user when the user is in a normal use position on the lower body exercise machine. The resistance device is adapted to provide resistance to a full natural arm swing of the user, and the mounting arm is adapted to be positioned on the lower body exercise machine in a position that avoids interference with an egress path directly behind the user in the normal use position on the lower body exercise machine. The mounting device may be adapted to be retrofitted onto the lower body exercise machine or permanently attached to the lower body exercise machine.

Another aspect of the invention comprises an exercise reel comprising an elongated connector; a user engagement connected to one end of the elongated connector for engaging a body appendage; a spool connected to the other end of the elongated connector on which the elongated connector is adapted to be wound; a shaft on which the spool is axially mounted; and a resistance mechanism for resisting unwinding of the spool. The resistance mechanism comprises a braking cylinder fixed axially to the shaft, and a band brake for frictionally engaging the braking cylinder. A

retraction mechanism automatically rewinds the spool. A clutch located at an interface between the spool and the shaft engages the shaft when the spool is being unwound and disengages the shaft when the spool is being rewound, such that the braking cylinder turns only when the spool is being unwound.

Another aspect of the invention comprises an exercise apparatus for exercising the upper body simultaneously with lower body exercise, the apparatus comprising a lower body exercise machine and at least one upper body exercise module positioned for use in conjunction with the lower body exercise machine. Each upper body exercise module comprises an elongated connector having first and second ends; a user engagement connected to the elongated connector first end for engaging or being engaged by a body appendage of a user; and a resistance mechanism for resisting a force applied to the first end of the elongated connector. Each upper body exercise module adapted to provide resistance to a full, natural arm swing of at least one arm of the user.

Still another aspect of the invention comprises a method of total body exercise comprising an exerciser performing an upper body exercise simultaneously with a lower body exercise, wherein the upper body exercise comprises exercising with a full, natural, multiplanar arm swing against a resistance force. The resistance force transmitted to the exerciser via a user engagement at one end of a connector connected to a source of the resistance force, wherein the exerciser engages the user engagement with a loose or open grip. The user may adopt a slower pace and take deeper, more rhythmic breaths as compared to the user using the lower body exercise machine without simultaneously using the upper body exercise module.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1A is a perspective view illustration of a user on an exemplary treadmill outfitted with exemplary upper body exercise modules.

FIG. 1B is a perspective view illustration of a user on a treadmill similar to that of FIG. 1A but with a single upper body exercise module embodiment.

FIG. 1C is a perspective view illustration of a single upper body exercise module embodiment similar to that of FIG. 1B but with guides for the cable.

FIG. 1D is a perspective view illustration of a arrangement for resting the user engagement in a non-use position.

FIG. 2A is an exploded plan view illustration of an exemplary spring-return cable spool mechanism.

FIG. 2B is perspective view illustration of the partially assembled exemplary spring-return cable spool mechanism of FIG. 2A, with the housing shown removed to reveal the inner workings.

FIG. 3A is an illustration of a hand loop user engagement.

FIG. 3B is a plan view illustration of an exemplary micro-hook/micro-loop adjustable hand loop embodiment.

FIG. 3C is an illustration of an exemplary adjustable cable-through-ring hand loop embodiment.

FIG. 4A is a plan view illustration of an exemplary single reel embodiment.

FIG. 4B is a partial cross-section side view illustration of an exemplary resistance mechanism on the single reel embodiment shown in FIG. 4A.

FIG. 5A is an illustration of an exemplary cross-country ski machine having two forward-stroke upper body exercise modules.

FIG. 5B is an illustration of an exemplary elliptical machine having two forward-stroke upper body exercise modules, two backward-stroke upper body exercise modules, and a support structure.

FIG. 5C is an illustration of an exemplary trampoline having two forward-stroke upper body exercise modules and a support structure.

FIG. 5D is an illustration of an exemplary stepper having two forward-stroke upper body exercise modules and a support structure.

FIG. 5E is an illustration of an exemplary recumbant exercise bicycle having two forward-stroke upper body exercise modules.

FIG. 5F is an illustration of an exemplary rowing machine having two backward-stroke upper body exercise modules.

FIG. 5G is an illustration of an exemplary torso-twisting disk exercise machine having two forward-stroke upper body exercise modules.

FIG. 5H is an illustration of an exemplary air walker/glider exercise machine having two forward-stroke upper body exercise modules.

FIG. 5I is an illustration of an exemplary upright exercise bicycle having two forward-stroke upper body exercise modules mounted to a foot of the machine.

FIG. 5J is an illustration of another exemplary upright exercise bicycle having two forward-stroke upper body exercise modules mounted to a crossbar mounted to the back of the machine and depicting an alternate embodiment where the exercise modules may be mounted at the front of the machine.

FIG. 5I is an illustration of an exemplary upright exercise bicycle resting on top of an exemplary platform having two forward-stroke upper body exercise modules mounted thereon.

FIG. 6A is an illustration of an exemplary exercise reel in a freestanding floor-mounted configuration with a crossbar as a user engagement.

FIG. 6B is an illustration of an exemplary exercise reel in a freestanding wall-mounted configuration with a crossbar as a user engagement.

FIG. 6C is an illustration of an exemplary exercise reel in a freestanding ceiling-mounted configuration with a crossbar as a user engagement.

FIG. 6D is an illustration of an exemplary freestanding platform having two exercise reels mounted thereto for upper body exercise.

FIG. 6E is an illustration of an exemplary freestanding platform having a single-reel exercise reel embodiment mounted thereto.

FIG. 6F is an illustration of an exemplary freestanding platform having a two exercise reels mounted thereto for leg exercises.

Fig. 7 is a perspective view of an exemplary treadmill embodiment having a plurality of exercise reels mounted thereon.

Fig. 8 is a side view of an exemplary treadmill embodiment having helical spring resistance devices mounted underneath the treadmill.

FIG. 9 is a plan view of an exemplary treadmill embodiment having a single reel mounted to the front thereof, with guides to direct the cable to a point behind the user.

FIG. 10 is a partial longitudinal section illustration of an exemplary pole mounted on a helical spring for mounting to an exercise machine.

FIG. 11A is an illustration of an exemplary treadmill having poles mounted thereon with a ball and socket resistance mechanism.

FIG. 11B is an illustration of an exemplary articulated pole embodiment.

FIG. 12 is an illustration of an exemplary stepper exercise machine having the resistant units attached to the steps.

FIG. 13 is an illustration of an exemplary foot surface for providing enhanced balance for a user.

FIG. 14 is a side view illustration of an exemplary treadmill having an upper body exercise device mounted on a vertically pivotable mounting device

attached to the treadmill, showing the mounting device in a use position in solid lines and in a non-use position in dashed lines.

FIG. 15A is a side view illustration of an exemplary treadmill having an upper body exercise device mounted on a vertically pivotable mounting device that attaches to a foot of the treadmill, showing the mounting device in a use position in solid lines and in a non-use position in dashed lines.

FIG. 15B a plan view illustration of a side portion of the treadmill showing the mounting device in a non-use position.

FIG. 16A is a side view illustration of an exemplary treadmill having an upper body exercise device mounted on a slidable mounting device that attaches to the side of the treadmill, showing the mounting device in one of a number of selectable use positions.

FIG. 16B is a side view illustration of the exemplary treadmill, upper body exercise device, and slidable mounting device of claim 16A, showing the mounting device in a non-use position.

FIG. 17A is a side view illustration of an exemplary treadmill having an upper body exercise device mounted on a horizontally pivotable, vertically adjustable mounting device that attaches to the side of the treadmill, showing the mounting device in a use position in solid lines and in a non-use position in dashed lines.

FIG. 17B is a side view illustration of an exemplary treadmill having an upper body exercise device mounted on a horizontally pivotable, non-vertically adjustable mounting device that attaches to the side of the treadmill, showing the mounting device in a use position in solid lines and in a non-use position in dashed lines.

FIG. 17C is a side view illustration of an exemplary treadmill having an upper body exercise device mounted on a horizontally pivotable, vertically adjustable mounting device that attaches to the side of the treadmill, showing the mounting

device in a first use position in solid lines and pivoted to a second use position in dashed lines.

FIG. 18A is a perspective view illustration of an exemplary mounting device that attaches to the foot of a lower-body exercise device such as a treadmill.

FIG. 18B is a side view illustration of a foot of a lower body exercise machine taken from underneath the machine to show how the mounting bar portion of the mounting device of FIG. 18A attaches to the foot in an exemplary embodiment.

FIG. 18C is a rear view illustration of the foot of the lower body exercise machine of FIG. 18B.

FIG. 18D is a side view illustration of the foot of the lower body exercise machine of FIG. 18B taken from the opposite side shown in Fig. 18B.

FIG. 19 is a perspective view illustration of an exemplary flared-top hand grip.

FIG. 20A is a plan view illustration of an exemplary exercise device with a top mounting piece removed.

FIG. 20B is a top view, partial-cut-away illustration of the exemplary exercise device of FIG 20A.

Fig. 21 shows a top view of an exemplary flared-top hand grip being held in a user's hand.

Fig. 22A shows a perspective view of an exemplary interface between an exercise machine and an exemplary mounting bar of an exemplary mounting arm, shown from a perspective to one side of the machine.

Fig. 22B shows a perspective view of one end of the mounting bar shown in Fig. 22A.

Fig. 22C shows a side view of the mounting bar end assembly for holding the mounting bar in place on the machine.

Fig. 22D shows a perspective view of the exemplary interface of Fig. 22A, shown from underneath the machine.

DETAILED DESCRIPTION OF INVENTION

The invention will next be illustrated with reference to the figures. The figures are intended to be illustrative rather than limiting and are included herewith to facilitate the explanation of this invention.

Referring now to FIG. 1A, there is shown a user 14 on an exercise machine 10, namely a treadmill. Machine 10 comprises two resistance modules of this invention, namely exercise reels 1800 (shown in more detail in Figs. 18A, 20A, and 20B), mounted behind user 14 to be used for exercising the user's arms. Reels 1800 are positioned on mounting arms 1802 to enable the natural, free-swinging back and forth motion of arms 16 of user 14. User 14 swings each arm 16 forward in an upward arc along arrow A, extending from below the waist or preferably behind the user's body at or to the rear of point B, and moving alongside to point C in front of the user's body. Most of the effort is exerted by pulling and lifting the arms on the upswing (in the direction of arrow A), while letting the arms swing backward freely on the downswing (opposite the direction of arrow A).

It should be noted that some figures in this application and text corresponding thereto show or refer to one or more reels 1800 and while others show or refer to one or more reels 12. Reels 12 and 1800 are interchangeable, however, with respect to all of the embodiments shown or discussed herein. Reels 12 and 1800 may alternatively be referred to herein generically as "resistance modules" or specifically as "exercise reels" or simply "reels."

One aspect of the invention allows the user to maintain this natural arm swing motion while exercising, and in so doing provides a superior exercise workout. Resistance modules 12 or 1800 may be permanently attached to exercise machine 10

or may be detachable, and may be used to retrofit a pre-existing machine. Although mounting the devices behind the user for use in providing an arm workout is one preferred embodiment, the resistance devices of this invention may be placed anywhere on an exercise device in relation to the user, for use in working-out any portion of the user's body. Although any number of resistance units may be provided, a preferred embodiment comprises two resistance units, one for each arm and/or leg. Although four units may be provided so that both legs and both arms may be exercised simultaneously, one preferred embodiment comprises two units that may be adjustable for use with either arms or legs.

The resistance units may be permanently affixed to the machine, or may be detachable and removable. The resistance units may also be fixed in a particular place on the machine, but are preferably adjustable in one or more dimensions. For example, as shown in Fig. 7, each reel 12 may be mounted on a shaft 700, each shaft pivotable in the direction of arrow Z to provide adjustability forward and backward relative to the user. Each reel may also be slidable up and down shaft 700 along arrow Y, such as on a track, providing vertical adjustability. Although not shown in Fig. 7, shaft 700 may be jointed to allow pivoting toward and away from each other, to provide right-to-left adjustability relative to the user. The arrangement shown in Fig. 7 is merely one example of how resistance mechanisms can be provided with adjustability in more than one direction. Any other structural arrangements known in the art may be used to provide one, two, or three directions of adjustability (up/down, forward/back, or left/right). Shafts 700 may be provided as part of the original equipment for the exercise machine, or may comprise a retrofit kit for attaching to existing exercise machines.

The resistance units may allow for adjustment in the amount of resistance, but units that are not adjustable may also be used. The adjustable resistance may be continuously adjustable within a certain range, may comprise incremental, stepped, non-continuous adjustment, or a combination thereof. For example, a kit may be provided having a first set of resistance devices for providing continuous adjustment between 1-5 pounds of resistance, and a second set of resistance devices interchangeable for the first set for providing continuous

adjustment between 5-10 pounds of resistance. Although typically exercise machines may be marketed with resistance devices having only a single range of resistance, machines may also be marketed with multiple ranges of resistance available, or conversion kits may be available for interchanging resistance units having one range with units having a different range. Instead of interchangeability, the resistance units may be stackable, one on top of the other, such as described in U.S. Patent No. 5,733,231 to Corn et al., which is hereby incorporated by reference. The noted ranges of resistance are merely exemplary, however, as any range of resistance may be provided. The resistance may be adjustable, for example, using a dial, such as dial 1851 shown in FIG. 18A, and the resistance level may be visually indicated using a gauge 1852. Gauge 1852 comprises a pin 1854 that moves in association with the chosen resistance level relative to markings 1856 on the device cover 1858.

Referring now to FIGS. 2A and 2B, there is shown an exemplary exercise reel 12 in further detail. Reel 12 is depicted in Figs. 2A and 2B as a spring-return cable spool reel, but other types of reels may also be used. In the embodiment shown in Figs. 2A and 2B, however, cable 217 is attached to cable spool 207 at one end and comprises user engagement, such as hand loop 219 on the opposite end. Although the cable may preferably be a plastic-coated, twisted-metal cable as is well known in the art, the term "elongated tension member" or "elongated connector" may be used herein to generically refer to any type of non-rigid connection member, such as a cable, line, cord, tubing, band, strip, rope, chain, string, or other means known in the art suitable for transmitting tensile resistance to the arm movement of the user from spool 207. Such a connector allows a full and free range of motion (motion in multiple planes) of the user's arm or other body part engaged by the user engagement. Even a rigid elongated connector may be used, however, for example as shown in Figs. 11A and 11B, where a pole is provided as at least a portion of the connector and yet still allows a full and free range of motion.

For simplicity, however, many of the embodiments are described herein with respect to a "cable" (except where specific to other types of elongated connectors), but it should be understood that any applicable elongated connector may be substituted for the cable described in any of these embodiments. It is desirable for

exterior surface of the cable to be smooth, however, and for any edges against which the cable is likely to rub, such as for example edges of opening 1859 in covering 1858 as shown in Fig. 18A, to be beveled and/or also smooth to reduce noise.

Cable 217 may be non-elastic or may have some elasticity. Cable 217 is preferably just long enough to stretch from the mounting location of the reel to the furthest point of the user engagement from the mounting location during a standard arm swing. This furthest point, for example, may be chosen to be the length at which the universal user standing in a location farthest from the resistance device would pull out the cable when his forward arm swing is at eye level. As used herein, the term "universal user" means a hypothetical user requiring system dimensions that would be sufficient to accommodate any other intended user. Thus, for a reel mounted behind the user, the length corresponds to the length of a full forward arm swing, and for a reel mounted in front of the user, the length corresponds to a full backward arm swing. The spool is preferably sized to just hold substantially all of the length of the cable. By "substantially all," it is meant the portion of the cable not including user engagement 219 or any portion of the cable between the cable thimble 218 and the user engagement. By "just hold" it is meant that the spool is preferably not substantially oversized, so as to conserve weight and size and to minimize cost. Restricting the length of cable and spool capacity enables a more compact unit than if, for example, the length of cable were indiscriminately long and the size of the spool were correspondingly large. For example, previously known reel devices for use in aquatic training would be unreasonably bulky for use in the present application.

In one embodiment, the user engagement may be a comfortable, "hands-free" design that may be in the form of a padded, soft, non-chafing hand loop 219, such as is shown in FIG. 2B, or any other type of strap or grip that fits around the hand without requiring a closed grip by the hand. A material such as a dense foam rubber may provide the padded, soft, and non-chafing qualities. The user engagement may comprise any of the suitable mechanisms known in the art for enabling engagement by or attachment to a portion of the upper body, however, such as but not limited to handles, grips, bars, wraps, gloves, straps, cuffs, and the like. In other embodiments, where the exercise reel of this invention is used for the exercise

of other muscles, the user engagement may be any device for engaging any part of the body, including the feet or legs, the waist, the torso, the head, the shoulders, and the like. Thus, although referred to as a "hand loop" herein, it should be understood that loop 219 may be used for engagement of other parts of the body. The user engagement may be permanently attached to or detachable from cable 217. Upper body user engagements may be designed to be attached to, engaged by, or held by any portion of the arms, wrists, hands, or fingers of the user. The user engagement may be securable to the arm or hands by any mechanism known in the art, such as but not limited to the user grasping or holding the means, or the means being secured to the user by any type of fastener such as one or more buckles, Velcro® fasteners, snaps, pressure fittings, hooks, loops, clips, and the like. User engagements for other parts of the body may be securable to the feet, legs, waist torso, head, shoulders, and the like. The user engagement is preferably padded for comfort, and/or lined for sweat absorption.

Although the user engagement may be a member suitable for gripping by the user, a loop is advantageous because it may simply engage the user's hand 17 in a naturally open position as shown in FIG. 3A with the loop passing between the user's thumb 19 and forefinger 20. Loop 219 may also be adjustable for sizing and comfort, while allowing for a quick release of the hands. For example, as shown in FIG. 3B, loop 319 comprises a section 302 of micro-hooks and mating section 304 of micro-loops (or vice versa), such as a commonly known Velcro® fastener, that enables the diameter D of loop 319 to be adjusted. Any number of equivalent devices for providing adjustability are known in the art and may be used, however, such as but not limited to snaps, buttons, a "cable-through-ring" mechanism 419 such as is shown in FIG 3C with cable 417 and ring 418, and the like.

Another desirable embodiment for the user engagement is shown in Figs. 19 and 21. Hand grip 1900 comprises a flared top 1910 and a plurality of indents 1920 and 1921. Although shown with one indent 1920 for the user's thumb and one indent 1921 for the remaining fingers, any number of indents may be provided, including but not limited to, no indents, a single indent for the thumb and fingers together, or an indent for each of the thumb and fingers. Flared top 1910

distributes the pressure of the forward swing to the top of the hand 2100 to the thumb 2102 and fore-finger 2104, which stop the grip from slipping through the user's hand as shown in Fig. 21, and therefore allow the user to use a loose grip. Grip 1900 is also shown with an eyelet 1930 for engagement by, for example, a pinch-type clip 1940 at the end of elongated connector 1950. A detachable user engagement provides interchangeability of user engagements, which is a particularly desirable feature, because it allows the user to change the type of user engagement to accommodate the type of exercise. For example, a flared-top grip 1900 may be preferable for an aerobic exercise, whereas a more standard pull-type handle (not shown) may be more desirable for use for strength exercises, and a loop-type engagement may be more desirable for use with another part of the body, such as for leg exercises.

The use of a padded, non-chafing loop or a flared-top grip for engaging the hand provides an open engagement by the hand that exerts less pressure on the hand or wrist than a closed grip. The open engagement of a padded loop or flared-top grip also avoids the undesirably higher blood pressure that, according to some sources, may be promoted by a closed grip. An open engagement as permitted by the flared-top grip or hand loop also does not tire or cramp the hand or fingers, nor does it rub or chafe the hand or fingers, making exercise over a longer time period possible. An adjustable and/or padded cuff (not shown) or hand loop 219 (such as is shown inn Fig. 3A) that merely slips around the user's wrist or hand, may also be used to avoid the drawbacks of a closed grip.

While the flared-top grip 1900 and loop or cuff type grips all offers the advantages of an open engagement, the flared-top grip offers the additional advantage of allowing the user to more quickly disengage the user engagement, by dropping it, if necessary. A loop may be somewhat more difficult to disengage quickly. The flared-top grip user engagement is particularly advantageous over the cuff-type user engagements, such as those shown, for example, in U.S. Patent No. 6,123,649 to Lee et al., incorporated herein by reference, which may tend to snare or catch the hand or arm and in which a user may be more likely to be tangled upon stumbling or falling, creating a potential safety issue. The flared-top grip 1900 is preferably made

of a padded, soft, non-chafing material, such as, for example, a dense foam rubber material.

Returning now to Figs. 2A and 2B, reel 12 further comprises a split housing having a left component 201 and right component 202 that enclose the moving parts. Shaft end caps 220 are attached to either end of shaft 205 to keep the assembled housing in place. Reel 12 also may comprise a swivel mount, such as yoke 203 and swivel tongue 204, that allows the reel to swivel with respect to its attachment point to the exercise machine. Although the yoke / swivel tongue mechanism allows only a single degree of freedom (pivoting in the either direction along arrow X), the swivel mount may comprise multiple swivel mechanisms, each of which provides additional degrees of freedom, or may comprise a single mechanism, such as a ball-and-socket mechanism that provides multiple degrees of freedom. Instead of being attached to shaft 205 running through cable spool 207, the swivel mount may also be attached to one or both of the housing components 201 or 202. A swivel mounting, in general, may protect the reel mechanism by reducing stresses on the reel. In other embodiments, however, the reel may be attached to the exercise machine, mounting bracket, wall, bench, platform, or the like, by a non-swiveling mechanism.

Reel 12 preferably has a retraction mechanism so that cable 217 is wound back on the reel as the user's arm moves backward on the back swing. As shown in FIG. 2A, an exemplary retraction mechanism embodiment comprises a retractor spring 206, such as a coil spring. Other retraction mechanisms may also be used. Spring 206 is loaded as cable 217 is unwound from spool 207 (and also exerts some resistance) and then automatically springs back to rewind the cable as the user moves hand loop 219 back below the waist and behind the body so that it can be pulled forward again to point C on the upswing to complete a full cycle of the arm swing. The retraction mechanism also enables reel 12 to retract cable 217 so that cable stop 218 abuts reel 12 when the reel is not being engaged by a user, to neatly store the cable when not in use. Cable stop 218 prevents too much cable, including hand loop 219, from being pulled into housing 201 and 202. Opening 230 in the housing is sized to keep cable stop 218 from being drawn inside.

The cord on the reel mechanism may fully retract up to cable stop 218, providing compact storage. In other embodiments, holders may be provided forward of the user for resting the user engagements where they may be readily picked up and put down by the user. For example, as shown in Fig. 1A, console 18 in front of user 14 may comprise wings 20 having upright posts 22 around which the loops 219 (shown in Fig. 2B) or upper eyelets 1960 of flared-top grip 1900 (shown in Fig. 19) may be optionally placed. For safety, posts 22 preferably have rounded, snubbed ends with a length just long enough to provide the required capability of docking the user engagement while not in use, without being cumbersome for retrieving the user engagement from the posts. So, a user wanting to discontinue the arm exercise portion of the workout for a period of time may merely continue exercising his legs while temporarily docking the user engagements on the machine where they can be readily picked up again without discontinuing the leg workout.

Although shown with posts 22, it should be recognized that any type of docking engagement mechanism may be used for temporarily storing the user engagement, including other male-female type engagements, for example, where a post is on the flared-tip grip and an eyelet is on the machine, or a partial ring engagement 1961 such as shown in FIG 1D through which cable 217 can be threaded but which prevents the relatively larger diameter of user engagement 1900 from being pulled through. The invention is not limited to any particular type of docking arrangement. Another exemplary docking arrangement 59 is shown with respect to an upright bicycle in Fig. 5I, wherein the docking station is positioned where a user can easily reach below the seat of the bicycle to grab the user engagement when desired. The docking station in this case comprises a crosswise rod 556 having an upturned end 557 over which eyelet 1960 may be placed. The crosswise rod may be attached to collar 558 which fits around seat pole 558 for attaching backrest 61.

Although shown in FIG. 2A as a spring 206, the retraction mechanism on reel 12 may be of any type known in the art, however, such as but not limited to a spring, weight, or elastic member. The cable retraction mechanism may even be motorized, if desired. The retraction mechanism may be adjustable to provide a range of retraction forces or may be non-adjustable. Preferably, the cable retraction

mechanism has sufficient strength to allow for a full backswing without line slack, which is some embodiments, for example, has been found to require a cable retraction mechanism exerting at least 0.5 pounds of force. In the exemplary embodiment shown in FIG. 1B and described herein later in which a single reel has a cable with one end used by the user's right arm and the other end used by the user's left arm, the retraction mechanism for one arm is powered by the forward stroke of the opposite arm.

Reel system 12 also has at least one resistance mechanism. In some embodiments, the resistance mechanism and retraction mechanism may be the same mechanism, or at least a portion of the resistance mechanism may also comprise at least a portion of the retraction mechanism. In other embodiments, at least some substantial portion of the resistance mechanism may be separate from the retraction mechanism. For example, spring 206 provides some resistance force as well as the retraction force. In the embodiment shown in FIGS. 2A and 2B, the resistance mechanism additionally comprises a brake disk 211 and a pair of caliper arms 212 and 213. The element providing the resistance may be anything known in the art, however, such as but not limited to a spring; an elastic member, including a tension band or ring; a weight, including weights that are lifted by pulling a cable wound about a pulley; a friction brake, including a brake on a reel or on the cable itself; a pressure pad; a screw; a device using magnetic, hydraulic, or pneumatic resistance; a bendable shape memory material such as a composite (i.e. a BOWFLEX® rod); or the like.

The resistance mechanism may be adjustable, such as for example, by turning caliper adjustment knob 216 which is connected to shaft 214. Shaft 214 is coaxially mounted within spacer 215 and has a threaded end that interfaces with threaded portion of left caliper arm 212 to change the distance between left caliper arm 212 and right caliper arm 213, as shown in FIG. 2A. Shaft 214 protrudes through housing component 202 via opening 221, allowing adjustment knob 216 to be accessible without removing the housing.

The resistance mechanism may also be non-adjustable. For example, if permanently set to be used for an aerobic workout, the arm mechanism may be non-adjustable and set to provide less than about 5 pounds of resistance, or even more preferably less than 3 pounds of resistance. If the arm mechanism is designed to provide a simulation of weight exercise, the arm mechanism may be adjustable to offer a range of different resistance forces that may typically exceed 5 pounds. This range of resistance forces may be infinitely adjustable within the range along a continuum, or the range may be adjustable stepwise.

As shown in FIGS. 2A and 2B, the resistance mechanism typically further comprises a clutch mechanism, such as roller clutch 210 that disengages from spool clutch hub 208 when spool 207 spins in the direction for retraction of cable 217, and engages it again when the cable causes the spool to spin in the opposite direction. The clutch mechanism allows retractor spring 206 to quickly rewind cable 217 on spool 207 without resistance. Embodiments without a clutch may also be provided.

Although shown in FIG. 1A with two reels 1800 with independent cables 2004 coming from each reel 1800, referring now to FIG. 1B, a single reel 112 may be shared by both arms. Reel 112, as shown in greater detail in FIGS. 4A and 4B, may comprise one cable 117a for one arm and another cable 117b for the other arm, each cable wound on spool 107 in a different direction. Cables 117a and 117b may be two distinct cables or may comprise a common cable with its middle section wound around spool 107. Reel 112 as shown in Fig. 1B may be mounted so that it can swivel up and down to accommodate users of different height while assuring that the tension forces on the cable are perpendicular to the axis of the spool. Referring now to FIG. 1C, to further facilitate a natural, straight forward and backward arm motion and to keep the cable from touching the back of the user's body, the single reel embodiment may further comprise a set of pulleys or guides 114 which move the origin point of the resistance force more toward the outside of and behind the body.

As shown in FIG. 4B, resistance may be provided in the single reel embodiment by a spring 110 mounted around shaft 120 of knob screw 122. As knob screw 122 is screwed downward to advance threads 123 into nut 126, which abuts one

end of spool 107 via washer 128, knob 124 compresses spring 110 so that the pressure exerted by the spring on spool 107 increases. FIG. 4B shows only one exemplary mechanism for providing resistance, however, and other mechanisms may be used as are known in the art without limitation. The advantages of a single reel embodiment include the simplicity of design and the economic benefit of having only a single reel and cable. Single reel embodiments may limit the motion of one arm to the opposite motion of the other arm, however, which in some circumstances may not be desirable. Furthermore, single reel embodiments can provide only the same resistance for each arm, and the cable is not fully retractable when not in use.

Although arm exercise reels 12 or 1800 are particularly useful for providing total body workouts for aerobic leg lower body exercise machines, such as on a cross-country skiing machine 510 as shown in FIG. 5A, an elliptical machine 520 as shown in FIG. 5B, a trampoline 530 as shown in FIG. 5C, a stepper 540 as shown in FIG. 5D, exercise bikes 550 (recumbant) and 555 (upright) as shown in FIGS. 5E and 5I-K, respectively, a torso-twisting disk 560 as shown in Fig. 5G, or an air walker/glider 570 as shown in Fig. 5H, the invention is not limited thereto. This invention may be used in conjunction with any type of exercise machine, such as but not limited to home gyms, strength training machines, upper body exercise machines, and the like, including specific machines such as but not limited to treadmills, air walkers/gliders, upright and recumbent bicycle machines, torso-twisting disks, cross-trainers, steppers, elliptical exercise machines, cross-country and downhill ski machines, trampolines, squat machines, rowing machines, stretching machines, abdominal machines and the like. It should be noted that although Figs. 5A-5K show the exercise machines with reels 12 or 1800 mounted at the foot level of the user, any type of resistance module may be used. Regardless of resistance module type, the resistance module may be provided with or without mounting arms, such as arm 1802 shown in Fig. 18A or the arms shown in Figs. 14-17C, that raise the level of the resistance module above foot level. Mounting stub 2001 of reel 1800 may be attached directly to an exercise machine, such as to mounting post 1880 on bicycle foot 559, as shown in Fig. 5I. In other embodiments, the resistance devices may be placed on a platform 50, such as shown in Fig. 6D and 5K, and the exercise machine placed atop

the platform so that the weight of the machine and the user provides the necessary force to hold the platform with the resistance devices in place.

Because of the backward resistance force applied by the arm-exercise mechanism, in some embodiments it may be desirable to include one or more attendant structures for counteracting forces transmitted by the resistance device that may tend to destabilize the user. Such structures may include a support structure behind the user, and/or, for devices such as steppers with a limited area for engaging the foot, an oversized or at least full-sized foot support. For example, as shown in Fig. 13, foot support 1300 has a length L and width W greater than the comparative length and width of a human foot 1302, and optionally further comprises a raised lip or railing 1304 on the periphery to make it easier for the foot to stay in the foot support area. The foot support area surface 1306 may optionally comprise a high-traction material.

Exemplary support structures 60 behind the user are illustrated in FIGS. 5B, 5E, and 5G-I, and may be provided to minimize the possibility that a user may lose his or her balance. The support structure may be designed to support the back or buttocks of the user, and may be adjustable in one or more directions, such as up/down, right/left, and forward/back. For example, as shown in Fig. 5D, support 60 may rest on a pole 63 that pivots forward and backward in the direction of arrow Z, and support 60 may further be adjustable up and down the pole along arrow Y. Other mounting means for support 60 may also be used, however, such as a crossbar behind the user supported by a pair of posts. Any means for mounting the support may be used, but optimally should not interfere with the natural, free-swinging arm motion of the user. In an exemplary recumbent exercise bicycle embodiment 550, back support 60 may comprise a back rest that is part of the seat 62, as shown in FIG. 5E. In another embodiment, as illustrated with respect to upright exercise bicycle 555, an independent back support 61 may be provided. Support structures may be particularly desirable for machines where there may be a risk of imbalance or instability, such as, for example, with an elliptical machine 520, trampoline 530, stepper 540, torso-twisting disk 560, or air glider 570, as shown in FIGS. 5B-5D, 5G, and 5H, respectively, where the user is in a somewhat elevated position when using

the machine. Support structures are not limited to use only with these machines, however, and may be provided on any machine, including but not limited to treadmills. Embodiments without such a support structure may also be provided for any type of machine.

Additional attributes may also be desirable for facilitating use of a resistance device mounted behind the user intended to provide resistance to a forward arm swing of a user on an exercise machine. For example, some known treadmill embodiments provide side railings and a console or control panel in front of the user. In such embodiments, the side rails are preferably spaced radially from the treadmill frame far enough, have a height low enough, and/or only extend from the front to the back of the machine far enough to avoid interfering with the natural arm swing of universal user. Similarly, any console, control panel, or grab rail mounted in front of the user are desirably either permanently fixed far enough forward that they do not interfere with the natural arm swing, or are adjustable so as to allow a full natural arm swing of a universal user.

The resistance provided by the exercise device is preferably unidirectional, preferably provided on the forward arm swing as shown in FIGS 1A, 1B and 5A-5E, 5G, 5H, 8, 9, and 12. The unidirectional resistance allows for two phases of exercise: an exertion phase (on the foreswing for rear-mounted devices) and a resting phase (on the backswing for rear-mounted devices). As shown in FIG. 5F, however, reel 12 may also be used to provide resistance for backward arm motion, such as for use with a rowing machine 560. Reels 12 or 112 may be used to provide resistance to forward or backward arm motion on any exercise machine known in the art. Although reel 112 shown in Figs. 4A and 4B is generally known for providing upper body exercise in conjunction with a cross-country ski machine, it has not been known for use with other exercise machines. Accordingly, it is within the scope of this invention to use reel 112 to provide resistance to forward arm motion when mounted to any exercise machine and to provide resistance to backward arm motion when mounted to any exercise machine other than a cross-country ski machine. Furthermore, the scope of this invention includes the use of any source of multi-planar (non-pole-type) arm swing resistance on any lower body exercise machine other than

a treadmill or a cross-country ski machine and the use of any source of multi-planar (non-pole-type) arm swing resistance permanently integrated with a treadmill. By "permanently integrated" it is meant that the arm-swing resistance is not a retrofit unit. Thus, this invention serves needs and fills gaps currently not addressed by existing exercise machines on the market.

A plurality of reels 12 or 1800 may also be used to provide bi-directional resistance both on the forward and backward swing. An exemplary bi-directional resistance design, shown in FIG. 5B, shows one reel 12a in front of the user and one reel 12b behind the user for each arm. The user may optionally use both reels 12a and 12b at the same time to provide resistance on the upswing and backswing, or may only use one reel at a time, to provide resistance on the upswing or the backswing, depending upon user preference. Although shown in FIG. 5B with use on an elliptical machine 520, the bi-directional resistance design is not limited to use on elliptical machines, nor are elliptical machines limited only to bi-directional designs.

Preferably the arm exercise mechanism has at least one anchor point for each reel 12 or 1800. The anchor point or points may be located anywhere, but are preferably located on the exercise machine itself, as shown in FIGS 1A-1C, 5A-5J, 7-9, and 12 or on a platform for mounting under the exercise machine, as shown in Fig. 5K. The anchor point may be located on the base or lower frame of the exercise machine, and preferably to the rear of the user at a height within a range between and including the user's feet to the user's hips, as shown, for example, in FIGS 1A-1C and 5A-5E, 5G-K and 7. In other embodiments, discussed herein later, the anchor point for the resistance device may actually be located somewhere other than behind the user, with guides used for bringing the cables to the rear of the user. Reels 12 or 1800 may be detachable or permanently or semi-permanently anchored. The attachment mechanism at the anchor point may be a quick-connect mechanism that allows for reels 12 or 1800 to be quickly replaced or moved easily from place to place around the machine, from machine to machine, or from machine to non-machine or free-standing locations. The attachment mechanism may also be a standard bolt and nut combination (with washers or special brackets as needed to adapt to each machine), or a pin 1810 and corresponding hole combination as shown in Fig. 18A.

The attachment mechanism may be adapted for easy detachment by the user, or may be intended to remain fixed without routine detachment by the user.

Reels 12 or 1800 may also be used in a free-standing mode. For example, one or more reels 12 may be mounted to any type of floor 600, wall 610, ceiling 620, pole, bench, or the like in a gym or home at a desired height to provide an arm and/or leg workout, as shown in FIGS. 6A-C. For these embodiments, the user interface may at the end of cable 217 may comprise hand loops 219 or handgrips 1900 as shown and described previously, may have a crossbar 619 similar to a weight-lifting bar on which weights are typically mounted, or may have any type of user engagement known in the art, including but not limited to handle-type grips 2300 as shown in Fig. 6D.

In another embodiment, as shown in FIG. 6D a pair of reels 12 or 1800 may be mounted on a platform 50 on which a user 14 may stand, with the opposite end comprising any of the user interfaces described previously. A user standing on platform 50 may thus approximate a curling or lifting exercise using free weights using the reel mechanisms of this invention, optionally with a bar (such as crossbar 619 shown in FIGS. 6A-C). A user lying on his or her back on platform 50 between reels 12 with a crossbar 619 connected to the respective cables may approximate a bench press exercise. A single reel 112 may also be used in a freestanding mode with or without a platform 50, as shown in FIG. 6E mounted on a platform. Single reel 112 may be mounted at an angle or on a swivel or cable guides may be used so that the pulling force is always perpendicular to the axis of the spool for smooth operation regardless of the height or position of the user. In one embodiment (not shown), the platform may be relatively small, with just enough size for the user to stand on, such that the user typically must keep one foot down at all times to prevent the platform from moving. In another embodiment, shown in Fig. 6D, the platform may be relatively large and heavy. An advantage of a relatively large, heavy platform is that the platform does not rely on the user stepping on it to keep it in place. Thus, the user may run in place, jump, stretch, perform kneebends, or other lower body exercises while using a relatively heavy platform. Although some lower body exercises may be possible in conjunction with upper body exercise on a lightweight platform,

exercises such as jumping and running in place are not readily facilitated. Platform 50 may also be used in conjunction with a lower-body exercise machine by placing the lower-body exercise machine on top of the platform, as shown in Fig. 5K.

Reels 12 or 1800 may also be used to exercise other body parts, such as the legs, in a natural motion. In one embodiment, loop 219 may be placed around the user's foot or leg, as shown in FIG. 6F and the user may perform leg lifts with a natural motion. For example, reels may be connected to a platform 50 and the user may position himself or herself against a wall 610 for balance. Such exercise may be beneficial for developing leg muscles above the knee and muscles in the waist and buttocks, and may further provide an enhanced aerobic workout. The use of reels for leg exercises is not limited to freestanding reels as shown in FIG. 6F, however, but may include reels mounted to exercise machines, benches, poles, walls, floors, and the like. The uses of the reels of this invention are not limited to exercising leg and arm muscles, however, as other muscles may also be exercised, such as muscles in the neck, midsection, shoulders, waist, and the like. Neck muscles may be exercised, for example, by using a headband as the user engagement means.

Thus, in one aspect, the subject invention solves a number of the problems associated with present dual action machines in one simple, compact, economic, easy-to-use mechanism. Embodiments including placement of the mechanism behind the user allow for a more natural, free-swinging arm motion and promotes a more natural, upright body position, which is safer for the user. The natural, free-swinging motion promotes better overall body coordination during exercise, as the upper body typically sets the rhythm for performing the exercise. As compared to pole-type mechanisms, the present invention provides a more flexible and versatile range of motion, allowing the user to choose the amount of upswing and backswing distance most comfortable for him or her and to choose the plane of motion relative to body most comfortable. Furthermore, the user may choose between dual action or non-dual action mode, and in some embodiments, unidirectional or bi-directional resistance.

The arm exercise mechanisms discussed herein, such as reels 12 or 1800, are relatively inexpensive to manufacture and are relatively easy and inexpensive to repair or replace. The mechanisms discussed herein are also lightweight and are compact for storage.

Other mechanisms besides reel mechanisms may also be used to provide total body workouts on lower-body-focused exercise machines. The use of elastic members for enhancing a workout is taught generally in U.S. Patents No. 5,405,305, No. 5,476,431, and No. 5,632,708, incorporated herein by reference. As used herein the term "elastic member" refers to any type of exercise bands, tubing, ropes, or cords known in the art that provide resistance to being stretched, and include any type of materials of construction, including natural and synthetic materials. Elastic members can also be made to have an adjustable resistance force. For example, by shortening the length of the elastic member that is allowed to stretch, the resistance provided by that member can be increased. Devices are known in the art to provide such shortening capability with relative ease of adjustment. One such device for use with exercise tubing is described in U.S. Patent No. 5,108,096 to Ponce, incorporated herein by reference, and another such device is marketed by Innotrainer of Tanumshede, Sweden, as described generally with respect to adjusting the distance between handles for aerobic exercise on www.innotrainer.com, also incorporated herein by reference. Thus, a pair of adjustment devices may be mounted to the frame of an exercise device, such as in the position of reels 12 shown in Fig. 7, and elastic members may be used to provide the resistance from behind the user.

Another mechanism for providing adjustable resistance with elastic members is to use a plurality of elastic members, with the ability to engage or disengage selected members to increase or decrease the resistance force. Use of the adjustable and/or padded user engagements described herein may be particularly advantageous over standard user engagements typically used with such elastic members, for all of the reasons discussed herein.

Although described above with respect to self-contained resistance mechanisms mounted behind the user, the resistance mechanism may be mounted

elsewhere on the machine and directed to a point behind the user with rollers, pulleys or guides. For example, as shown in Fig. 8, the resistance mechanism may comprise an elastic member or helical spring 800 mounted underneath the machine, with guides such as rollers or pulleys 802 for directing the cable to the user. Adjustability of the amount of resistance may be provided by increasing or decreasing the amount of pre-stress on the spring or elastic band, such as by shortening the length of the spring or band allowed to expand as a result of the workout, or by preloading the spring or band. An exemplary method of adjusting the preload on a helical spring is shown in Fig. 20 of U.S. Patent No. 6,123,649, incorporated herein by reference. The spring or elastic member may be enclosed in a tube if desired for aesthetic or safety purposes. Only one helical spring mechanism 800 is shown in Fig. 8, but it should be understood that optimally there is one spring mechanism for each arm to provide independent resistance. One embodiment (not shown), however, may comprise a single spring configured so that each end of the single spring serves as a spring mechanism for one of the arms.

As shown in the treadmill embodiment of Fig. 9, a single reel 112 may also be mounted in front of the user or under the machine with guides such as pulleys 900 and stays 902 provided for guiding the cables to a point behind the user to provide an exercise workout for the natural arm swing of the user. The use of a resistance device mounted in front of the user and guided to a point behind the user is not limited to treadmills, however, and may be used with respect to any type of exercise machine.

Although rear mounting of the resistance modules is preferred for providing resistance to a full, natural forward arm swing of a user, it may still be desirable to offer the user the option of alternatively providing resistance to the backswing. One simple way of providing this functionality, is to provide a pulley or guide 1875 at the front of the exercise machine, such as on console 18 as depicted in Fig. 1A, around which the cable 2004 can be wrapped to provide resistance from in front of the user. An alternative arrangement, is to provide mounting posts 1880 at the front of the machine to which the resistance devices 1800 can be mounted and held in place by inserting pins 1810 through holes 1882. The use of mounting posts

allows a user to optionally place reels at both the front and the back of the exercise machine to provide resistance to both the foreswing and the backswing, using the upper and lower rings 1930 and 1960 of a single grip 1900 as a point to which the cables from each reel can be fastened, such as using clips 1940 as shown in Fig. 19. Where a forward pulley or guide is used to enable a user to covert a rear-mounted resistance device to provide resistance to the user's arm backswing, it is important that the length of the cable and the carrying capacity of the spool is sized appropriately to provide enough cable to reach from the mounting point of the reel to the pulley and through a fully backswing of any sized user standing in any operating position on the machine. It may be desirable to provide the pulley or guide with a deep groove or channel to ensure that the cable stays engaged with the pulley or guide despite a non-zero angle between the portion of the cable entering the pulley/guide from the resistance device and the portion of the cable exiting the pulley/guide to the user. It may also be desired to provide a pulley that can swivel or rotate to provide an optimal orientation to accommodate such a non-zero angle.

When used with a treadmill, the resistance devices of the present invention provide an increased workout without requiring, for example, an inclined or motorized treadmill. The resistance devices of the present invention also enable a natural, free-swinging motion when walking or running on the treadmill. Thus, the relatively inexpensive addition of resistance mechanisms may eliminate the need for more expensive mechanisms, such as inclines or motors, typically used with treadmills known in the art. Of course, the resistance mechanisms may also be coupled with inclined and motorized treadmills for an even greater workout.

As described herein, one aspect of the invention comprises an exercise machine for exercising a user, the machine comprising an upper body exercise component comprising one or more resistance devices adapted to provide resistance to a forward swinging motion of an arm of the user while allowing the user's arm to perform the natural, free-swinging forward motion in a naturally extended arm position. The resistance device comprises a elongated connector having first and second ends and a user engagement connected to the elongated connector first end, wherein the user engagement is padded, adjustable, or a combination thereof.

Although the resistance device is preferably the exercise reel described herein, or one of the other resistance systems described above, any resistance device known in the art may be used in conjunction with such an exercise machine. For example, the following U.S. Patents, each incorporated herein by reference, describe exemplary resistance mechanisms, all of which may be used to provide resistance for the upper body workout: U.S. Patents No. 518,967 to Poole; No. 3,929,331 to Beeding; No. 4,114,875 to Deluty; No. 4,557,480 to Dudley; No. 4,779,866 to Marshall et al.; No. 5,147,264 to Braathen; No. 5,176,599 to Beliakov; No. 5,486,149 to Smith et al.; No. 5,618,249 to Marshall; No. 5,733, 231 to Corn et al.; Nos. 5,876,310 and 6,149,559 to Mackey, and No. 6,123,649 to Lee et al. This list is not limiting, however, as a multitude of other resistance devices are known in the art, and applicable for use as described generally herein.

Using resistance devices to provide upper body workouts on machines otherwise designed for lower-body workouts, provides greater exercise in less time, enabling a total body workout with more aerobic benefit. The increased exercise provides increased calorie consumption, as compared to equal time on a machine without the additional resistance mechanisms, ultimately leading to increased weight loss for those incorporating exercise into a weight loss regimen. The resistance devices also provide strengthening, toning, shaping, and stretching of the muscles using the devices.

Although described primarily herein where the resistance devices are independent from the lower body workout, the upper body resistance devices may be dependent upon the lower body exercise device. For example, as shown in Fig. 12, in a stepper-type machine 1200, each resistance unit 12 may be attached to one of the steps 1202 so that the stepping motion and upper body exercise motion are tied together. The feature of making the upper body exercise dependent on the lower body exercise may also be extended, as applicable, to any of the exercise machines discussed herein.

The resistance devices may be provided as original equipment on an exercise machine, or provided as retrofit units. Retrofit units may have components allowing universal or near-universal attachment to any machines known in the art.

Reel 12 as shown in FIGS. 2A and 2B and reel 1800 as shown in Figs. 18A, 20A, and 20B have a manual resistance adjustment effected by turning knob 216 or 2019, respectively. It should be understood that the resistance adjustment may also be motorized, such as with a remote control that activates a motor which turns shaft 214 or 2018. Motorized adjustment also enables adjustment of the resistance "on-the-fly", such as with a remote control integrated into the user engagement, or provided on the exercise machine, such as on a panel in front of or beside the user. Thus, the user may increase or decrease the resistance without stopping the exercise. The remote control may be provided by a knob or push button. For knob control, turning the knob one direction may increase resistance whereas turning the knob the other direction may decrease resistance. In push button embodiments, dual or single push button control may be provided, and the button or buttons may be integrated into the user engagement, such as hand grip 1900, if desired. In a single button mode, the adjustment may continuously run through a loop of increasing and decreasing resistance when the button is depressed, such that the user need merely hold the button down until the desired resistance is achieved. In a dual button mode, one button increases resistance and the other button increases resistance. Mechanical, as opposed to electrical, on-the-fly adjustment mechanisms may also be provided.

Although the devices as described herein for use with exercise machines have numerous advantages, one of the advantages is providing freedom of movement in multiple planes, which is typically not provided by the types of poles typically included for upper body exercise on lower-body exercise machines. Poles may be provided, however, that enable this functionality. In one embodiment, for example as shown in Fig. 10, a pole 1000 may be mounted axially on a heavy-gauge helical spring 1002 to enable movement in more than one plane. Resistance adjustment may be provided by adjusting the length of the portion of the spring allowed to bend. In another embodiment, shown in Fig. 11A, pole 1100 may have a ball 1102 at the end

that mounts in a socket 1104, with an adjustable member, such as a compression screw 1106, for adjusting the radial pressure on the ball for increasing and decreasing the resistance to movement of the ball within the socket. In some embodiments, to overcome the disadvantage of typical pole grips 1108 (shown on pole 1100), a user engagement 219 as described herein may be attached to the poles (illustrated with respect to right pole 1110), with an elastic or spring member 1112 provided to increase resistance and to provide a retraction mechanism for the pole on the backswing.

In yet another embodiment, shown in Fig. 11B, an articulated pole 1113 may used to provide resistance to a full natural arm swing. Pole 1113 comprises a lower portion 1118 that attaches to a ball 1102 that interfaces with a socket similar to socket 1104 shown in Fig. 11A. Additional ball and socket interfaces 1117 and 1115 may be present between upper portion 1116 and lower portion 1118 and between upper portion 1116 and grip holder 1114, respectively. Grip holder 1114 is adapted to hold a grip 1900 that enables a loose, open grip. The resistance at each ball and socket interface may be adjustable, or only at one of the interfaces, such as at the interface between ball 1102 and socket 1104 as shown in Fig. 11A.

The various embodiments described herein lend themselves to novel methods of exercising, including any exercise using the physical embodiments. A particularly novel exercise method comprises exercising the upper body with a natural, free-swinging arm motion, wherein resistance is provided to the arm motion by a resistance device providing tensioned resistance from a point of origin behind the user, and the resistance device is engaged by the user's upper body by means other than a closed grip, for example engagement by the hand in an open, loose grip such as provided by a user engagement described herein. The various exercise methods may comprise combining the upper body exercise with a lower body exercise, such as provided by any of the exercise machines discussed herein. The methods of exercise may include performing warm-up exercises, aerobic and/or strength training exercises, or cool-down exercises, and preferably may comprise a combination thereof integrated into an exercise program.

BAND-BRAKE TYPE RESISTANCE MODULE

Referring now to FIGS. 20A and 20B, exemplary resistance module 1800 is shown in more detail. As noted earlier, the reel embodiment shown in FIGS. 20A and 20B and the reel embodiment shown in FIG. 2A and 2B are interchangeable with respect to use with any of the exercise machines, exercise methods, or other accessories as described herein. Reel 1800 comprises a spool 2002 on which cable 2004 is wound and braking cylinder 2006 over which band brake 2008 is wrapped to provide resistance. A clutch mechanism 2007, such as a sprag clutch (also known in the art as a "needle-bearing clutch" or" needle-roller clutch bearing" as listed in the MCMASTER-CARR® online catalog, viewable at www.mcmaster.com), is mounted on shaft 2026 between the shaft and spool 2002 so that the shaft 2026 (and thus braking cylinder 2006) only turns when cable 2004 is being unwound from the spool. Coil spring 2010 powers the retraction mechanism. As shown in Fig. 20A, coil spring 2010 is mounted in a pocket 2005 formed by spool 2002, and fixed at one end to a pin 2011 attached to casing 2030 with the opposite end inserted in a slit 2013 that communicates with a channel 2015 in the outer wall of the pocket. A plurality of channels 2015 may be provided in the spool to reduce the weight of the spool. Any method of attaching the coil spring to an element that rotates with the spool at one end and to a fixed element at the other end, however, may be used.

Adjustable resistance is provided by tightening and loosening band brake 2008 using dial mechanism 2012. Dial mechanism comprises U-bracket 2014 attached to band brake 2008, traveler 2016 mounted on threaded shaft 2018, and helical spring 2020 mounted between the U-bracket and the traveler 2016. Threaded shaft 2018 rotates freely within mounting bracket 2022 and is kept from pulling out axially by end pin 2024. As shaft 2018 is rotated in a clockwise direction using dial 2019, traveler 2016 moves downward in the direction of arrow A, thereby also pushing U-bracket 2014 down in the direction of arrow A. This tightens band brake 2008 around braking cylinder 2006, creating a greater frictional resistance to turning the braking cylinder as cable 2004 is unwound from spool 2002. Spool 2002 and braking cylinder 2006 are mounted coaxially on a shaft 2026 which rotates within bearings 2028 and 2029 on first and second casing members 2030 and 2031, respectively.

First casing member 2030 has been removed in FIG. 20A to expose the contents between the casing members. As shown in Figs. 20A and 20B, casing members 2030 and 2031 together comprise a two-piece contoured cover, preferably molded plastic to make the system lightweight, although the casing members may be any materials of construction and may have any type of geometry. In one embodiment, the casing members may comprise flat metal mounting plates, wherein a lightweight protective and/or decorative cover (not shown) may be provided over the mounting plates to create a look similar to the design shown in FIG. 18A.

Clutch mechanism 2007 and bearings 2028 and 2029 are shown only schematically in FIG. 20B, and thus it should be understood that reel 1800 may comprise any types of clutches or bearings that are known in the art in any configuration. Although not visible in FIG. 20A, a pin 1854 such as shown in FIG. 18A may be attached to traveler 2016 and protrude through the mounting plate and cover 1858 to enable a user to quickly gauge the resistance level by viewing the pin relative to markings 1856 on the cover.

Mounting stub 2001, such as for mounting directly on an exercise machine via a mounting post 1880 as shown in Fig. 1A or for mounting at the end of an extension arm 1822 as shown in Fig. 18A, is provided between casing members 2030 and 2031. Particularly where casing members 2030 and 2031 may be made of lightweight plastic, mounting stub 2001 may be metal and attached to a metal frame 2003 to provide a strong attachment point.

Ball stop 2040 may be provided at the end of cable 2004 to prevent the cable from being rewound too far into the spool. Knob 2019 may be provided with visual indicia 2042 that indicates which direction to turn the knob to increase or decrease resistance.

At least some of the distinctions between the reel mechanism shown in Fig. 20A and 20B and a band-brake resistance reel system known in the art, marketed under the name CABLEFLEX™, the exterior design of which is shown in U.S. Patent No. D467,632, should also be understood. In addition to not being adapted for use with

other exercise machines, the CABLEFLEX system also has other drawbacks. For example, although the CABLEFLEX system includes a sprag clutch to prevent the band brake from being engaged during the recoil cycle, the location of the sprag clutch in the CABLEFLEX machine is between the shaft and the braking cylinder. By locating the sprag clutch at the interface between the spool and the shaft, the inventors have made the action of the spool smoother than that provided by the CABLEFLEX system when the cable is being unwound. By utilizing a band-brake resistance reel system for use behind a user on a lower-body exercise machine, the inventors have enabled providing resistance to a full, natural, forward arm swing of a user while performing lower body exercises, which greatly increases the workout available from the lower-body exercise machine.

MOUNTING SYSTEMS

There are typically at least 3 elements involved in mounting a resistance device to an exercise machine: a bracket for attachment to the machine, a fixed or movable arm for attachment to the bracket, and the exercise module itself. It should be understood, however, that the various elements may comprise a single integral device or may comprise any number of individual, separable pieces. Some embodiments may have no mounting arm. Figs. 1A, 5A-5K, 7, and 14-18D show treadmills or other lower-body exercise machines with exemplary mounting systems to provide resistance devices behind the user. While some figures, such as Fig. 5A, show a mounting bracket 13 to which the reel is directly attached to the exercise machine at approximately the foot level of the user without a mounting arm, Fig. 7 shows a mounting arm 700 that allows the reels to be elevated substantially above the user's foot level. The mounting arms may be permanently attached to the exercise machine, or detachable.

A plurality of other embodiments may be provided, however, some examples of which are shown in Figs. 14-18D. Fig. 14 shows a mounting arm similar to that shown in Fig. 7, but is shown with only a single resistance module 1800 mounted thereon, for simplicity. Although shown with resistance modules 12 or 1800 in the figures that follow, the resistance unit may be any type of resistance unit known

in the art, and each mounting arm embodiment is adaptable for use with either of reels 12 or 1800. Also, although shown only from one side in each of Figs. 14-17C, the opposite side of the machine typically contains a similar mounting arm in mirror image. To the extent possible, however, left-hand arms and right-hand arms may have identical features to minimize parts to be manufactured. Finally, it should be understood that the bracket for mounting the mounting arm to the machine and the mechanism for mounting the resistance device to the mounting arm may be comprise any mounting system known in the art, including but not limited to bolts, screws, welds, adhesives, VELCRO® fasteners, notches, pins, rivets, and the like.

One advantage of the arms for mounting resistance units as shown and described herein as compared to frames mounted behind a treadmill, such as those shown and described in U.S. Patent No. 6,123,649 to Lee et al., is that individual arms do not pose a similar risk of the user stepping back off the machine and tripping over the frame. The arms are mounted behind and to the sides of the user, thereby leaving a clear path for stepping back off of the machine. The arms may even be provided with a breakaway mechanism in the use position so that if a user were to hit the arm while falling backward, the arm would break away from the machine to avoid injury to the user. Additionally, the resistance module casing and arm may be provided with rounded edges and/or cushioned padding to prevent injury from users accidentally striking the arm or resistance device.

The embodiment shown in Fig. 14, comprises arm 1400 and pivot joint 1402. Pivot joint 1402 allows arm 1400 to pivot in a vertical plane along arc *A* between a use position shown in solid lines and a non-use or storage position shown in dashed lines. Pivot joint 1402 may comprise elements for limiting the range of motion to inhibit pivoting beyond the non-use position shown in dashed lines, and/or a rest 1410 may be provided on the side of the treadmill. Pivot joint 1402 and arm may be attached directly to the treadmill side rail, or may be attached to a mounting bracket 1404. Mounting bracket 1404 may be particularly well-suited for retrofitting existing treadmills, and may be provided with clamps, screws, or any other means known in the art for affixing the mounting bracket to the side rail 1403 of a treadmill or other component of any type of exercise machine. Mounting bracket 1404 may comprise a

pin, such as for example a spring-loaded post 1405, designed to interface with one or more holes 1406 in pivot joint 1402 to fix arm 1400 at a desired angle α from the non-use position. Post 1405 may then be depressed to allow arm 1400 to rotate about pivot joint 1402 again. Rather than a post on the bracket which interfaces with a hole on the pivot joint, the pivot joint may comprise the post and the bracket may comprise the holes into which the post clicks when the joint is in the desired position. In such an embodiment, the post is pulled outward to allow the arm to rotate again. Although shown in a preferable use position where α is approximately equal to 135°, pivot joint 1402 may allow rotation to 180° or more, or may enable only limited rotation to some other angle.

Another arm mounting system is shown in Figs. 15A and 15B. This system is particularly well-suited as a retrofit for pre-existing units. As used herein, the term "retrofit" is used to mean something not attached to original equipment at the factory. Typically, a retrofit unit is purchased by the consumer long after purchase of original equipment, but in some circumstances a retrofit unit may be packaged together with original equipment for installation by the purchaser.

The system shown in Figs. 15A and 15B comprises a base 1500 adapted to receive foot 1502 of treadmill 1504, and to which is pivotably attached arm 1506 having resistance device 1800 attached thereto. One or more bolts 1508 or other similar means may be provided to firmly secure base 1500 to foot 1502. As shown in the overhead view of Fig. 15B, arm 1506 is pivotably attached to base 1500 at pivot point 1510 by a pin or other means known in the art, and pivot point 1510 is preferably radially offset from foot 1502.

Figs. 16A and 16B show another system for mounting a resistance device behind a user in a way that allows for adjustment between a use position shown in Fig. 16A, and a non-use or storage position shown in Fig. 16B. Arm 1600 has a horizontal component 1602 and a vertical component 1604. Horizontal component is adapted to slide in a horizontal plane along arrow A within bracket 1606. Horizontal component 1602 has holes 1603 adapted to align with holes 1607 in bracket 1606 such that pins 1608 and 1609 can be inserted through the holes in both

the bracket and the horizontal component to affix the arm in a desired position (the portion of Figs. 16A and 16B showing pins 1608 and 1609 has been enlarged for easier viewing). Vertical component 1604 may also have one or more holes 1610 into which resistance device 12 may be mounted to enable vertical adjustment of the location of device 12. Other methods of vertical adjustment may also be provided.

Figs. 17A-17C show arm mounting systems which allow the arm to pivot along a horizontal plane along axis I at pivot point 1701 from a use position as shown in solid lines to a non-use position shown in dashed lines in Figs. 17A and 17B. Only the use position is shown in Fig. 17C. Arm 1700 shown in Fig. 17A has a horizontal component 1702 attached to the treadmill siderail 1704 and a vertical component 1706 attached to the horizontal component. Vertical component 1706 shown in Fig. 17A comprises an inner component 1708 which is vertically slidable within outer component 1710 to enable vertical height adjustment of resistance device 12 along arrow B. Holes 1712 in outer component 1710 align with holes 1714 in inner component 1708 and interface with pins 1716 to lock the inner and outer components in a desired configuration to provide the desired height for resistance module 1800. Brace 1718 is option, and may or may not be required for structural rigidity, depending on the robustness of construction. Any type of bracing or structural enhancement may be provided for any of the embodiments shown schematically herein, as desired.

In the arm configuration shown in Fig. 17B, resistance module 1800 attaches to the end of horizontal component 1734, which is attached to the vertical component 1732 of arm 1730, which is attached to the treadmill siderail 1704.

The arm configuration shown in Fig. 17C depicts another way in which vertical adjustment can be provided. Resistance module 1800 is provided at the end of an angled, component 1770 which pivots along a vertical plane at pivot point 1772 as shown by the dashed lines.

Figs. 18A-18D show another exemplary embodiment for mounting a reel-type resistance device to the rear of an exercise machine such as a treadmill. The

mounting system comprises module 1800, extension arm 1802, and mounting bar 1804 perpendicular to the extension arm. As shown in Figs. 18B-18C, mounting bar 1804 extends through foot 1806 of treadmill 1808 and is held in place by pin 1810 that extends through brace 1812 to rotationally lock arm 1802 in a fixed position. Pin 1810 may have a spring-biased depressible knob 1811 to allow quick insertion and removal of the pin from the mounting bar 1804. Although shown with a ring 1809 on the opposite end of the pin from the knob in Fig. 18A, any element may be provided that prevents the pin from being pushed into the mounting bar too far. When it is desired to place the extension arm in a non-use position, the pin may be removed from the brace 1812, and the arm pivoted forward to a resting position, such as shown with respect to the arm shown in Fig. 14. A rest, such as rest 1410 shown in Fig. 14 may be provided for resting the arm in the non-use position, or a second brace and hole may be provided on the foot in which to replace the pin to hold the arm in the non-use position.

A similar pin 1810 and corresponding hole may be provided at the point where mounting stub 2001 of module 1800 interfaces with arm 1802, so that the modules having different ranges of resistance may be interchanged, or so that the module may be reversed 180° so that it faces the back of the machine. A user may then use the module without being on the machine, for warm-up exercises, strength exercise, or any other type of use desired. Additional holes may be provided in arm 1802 so that the module may be rotated more or less than 180°, or an interface between the module and the arm may be provided that allows infinite or stepped adjustment in a plurality of rotational positions. The interface between the module and the arm is not limited to any particular engagement, and may comprise any type of engagement known in the art for allowing a device to be fixed in a first rotational position and then subsequently manipulated and fixed in another rotational position.

Arm 1802 is has a lower portion 1820 and an upper portion 1822, with an angle α between the upper and lower portions. As shown in Fig. 18A, angle α is roughly 150°, but any angle between 90° and 180° inclusive may be provided. As shown in Fig. 18D, lower portion 1820 is angled relative to horizontal at angle β at approximately 45°. The angle β may be any angle between 0° and 90°, inclusive,

however. It is desirable for the cooperation of angles α and β to orient module 1800 behind the user a desired distance at a desired height and at a desired angle to the user that provides for smooth, natural operation of the device.

One advantage of the mounting arm shown in Figs. 18A-18D is that it is easily removable from the exercise machine when desired, and provides a mounting behind the machine that is not likely to be in the user's way when the user steps off the machine.

Fig. 18A shows an extension arm 1802 and mounting bar in solid lines for mounting the arm to the user's left when the user is facing forward on the machine. Such an embodiment may require manufacture of a left-oriented arm and a right-oriented arm that is a mirror image of the left-oriented arm. To reduce manufacturing costs, however, an arm having a T-shaped mounting bar such as shown in the combination of solid and dashed lines in Fig. 18A may be provided to allow for use of the arm on either side of the machine. In another alternative, not shown, the treadmill may be provided with a mount on each side of the machine into which extension arm 1802 (without the horizontal mounting bar portion 1804) may be pinned. The interface between the treadmill and the machine is not limited to any particular type of interface, however, and may provide for a single arm structure that fits both sides, or different arm structures for each side.

Another mounting bar embodiment is shown in Figs. 22A-22D. Fig. 22A shows mounting bar 2200, which is part of mounting arm 2202, inserted into mounting sleeve 2204, which is part of foot 2206 of exercise machine 2208. Mounting sleeve 2204 comprises at least one, and preferably a plurality of, notches 2210. These notches interface with positioning pin 2212 on the mounting arm 2202 to hold the arm in a particular rotational position relative to the mounting sleeve. Once the mounting arm is aligned in the desired rotational position as shown in Fig. 22A, mounting cap 2220 is affixed to the end of mounting bar 2200 from underneath the machine. Mounting bar 2200 comprises a bolt hole 2214 having female threads as shown in Fig. 22B and mounting cap 2220 comprises a male threaded bolt 2216 which screws into bolt hole 2214.

As shown in Fig. 22D, spring 2222 extends over the portion of mounting sleeve located underneath the machine and abuts an inner surface of the machine foot to provide resistance to movement of the mounting bar in an outward direction. This spring provides enough resistance to keep the positioning pins securely in the notches during normal operation of the resistance device, but allows a user to pull the mounting bar outwardly far enough to disengage the pins from the notches to rotationally move the arm, such as to put the arm in a storage position. Thus, once the user has attached the mounting arm to the machine with mounting cap 2220, it is unnecessary to repeatedly remove mounting cap 2220 to re-position the arm.

Although shown in an exemplary embodiment in Figs. 22A-D, any number of embodiments having a similar function can be devised, whereby an element or elements on the mounting bar or mounting arm (such as the mounting pins) interfaces with an element of the mounting sleeve or equivalent thereof (such as the notches) to prevent rotational movement until manipulated in a particular way by the user (such as by pulling against spring-biased mounting cap). Similarly, although the mounting cap is shown with a bolt and mounting bar with a bolt hole, the position of the male and female members may be reversed, or any type of interfacial elements may be used. What is important is that the mounting bar and the exercise machine interface in such a way so as to have multiple positions including at least a use position and a non-use position.

It should also be understood that while it is desirable in some embodiments to provide a mounting arm or extension of some sort on which to mount the upper body exercise module to the lower body exercise machine, the upper body exercise module may be attached directly to the machine without such an extension or arm. For example, mounting posts 1880 as shown in Fig. 1A have show no appreciable extension from the machine, and although shown in the front of the machine, may be similarly mounted in the rear of the machine. In other embodiments, the upper body exercise module, or some portion thereof, may be attached directly to some portion of the lower body exercise machine without any type of mounting post or bracket, such as, for example attachment using a bolt through the

casing of the module. Fig. 5E shows such an installation, which may also utilize a mounting bracket, if desired.

APPLICABILITY TO ALL TYPES OF EXERCISE MACHINES

Although various exercise machines are shown and discussed herein, many of the inventive concepts have been illustrated particularly with respect to treadmills. No limitation to treadmills is intended for any of these concepts, however, and to further illustrate this point, a number of the concepts previously discussed will now also be illustrated with respect to exercise bicycles, with no limitation intended with respect to bicycles.

As shown in Fig. 5I, an exercise bike may have resistance units 1800 mounted directly to the exercise bike, for example at the foot of the unit, so that the resistance force emanates from a points to the rear, below the seat, and to the right and left sides of the user. This position allows a full, natural arm swing. As with other exercise machine embodiments, however, the resistance devices may be mounted anywhere on the machine and may provide a resistance force that emanates from any direction desired. The location below and behind the seat, however, is desirable because it allows full extension of the arm backward so that resistance is available from the start of the foreswing, and the location to the side of the user prevents interference with the path of the bike pedals. Also as with other embodiments, the resistance module may be permanently attached to the exercise bike, or removably attached.

The resistance unit may also be mounted to the machine indirectly via a mounting arm, as shown with solid lines in Fig. 5J. Mounting arms may be mounted to the foot of the bicycle, or to other parts of the unit, depending on the bicycle design. For example, for a SPINNER® bicycle design such known in the art such as is shown in Fig. 5J, a mounting arm 2314 may be mounted on shaft 2310 that extends to the foot 2312 of the machine. Mounting arms may be adjustable vertically, such as in one or more placement positions on shaft 2310 in the direction of arrow A, and/or horizontally, such as by having a variable extension distance from the shaft in the

direction of arrow B. Mounting arms designs such as arm 1802 shown in Fig. 18A, or any type of mounting arm that places the resistance device in a desired location, may be used. Referring now to the dashed lines in Fig. 5J, and as has been illustrated in a number of other exercise machine embodiments, an exercise bicycle embodiment may instead have the resistance modules 1800A mounted to the front of the machine, with a guide or pulley 2320 mounted to the rear of the machine to redirect connector 2400A to the user.

As noted with respect to other exercise machine designs, specifically treadmills, for a bicycle the path of connector 2400 to the resistance unit from each point in the path of the user's natural arm swing must be clear of any interference from the bicycle. Specifically, the path of the bicycle pedals 2300 and the location of the handlebars 2302 must not interfere with the path of the handgrip 1900, connector 2400, or resistance unit 1800 itself, or any mounting device for connecting the resistance unit to the bicycle. To accommodate different sized users, the location of the bicycle seat may be adjustable frontward and backward on the machine along arrow C as well as vertically along arrow D as is known in the art. The handlebars may also be adjustable horizontally and vertically along arrows E and F, respectively, and may also be rotatable along arrow G. The handlebars are preferably adjustable into at least one position in which the handlebars are completely out of the way of the natural arm swing of the user. Pegs 2350 on which to rest the eyelets 1960 of handgrips 1900, or other means for resting the handgrips when not in use, may be provided in a location readily accessible by the user.

In yet another embodiment, as shown in Fig. 5K, resistance modules 1800 may be mounted on a plate 50, such as the plate shown in Fig. 6D, where the weight of the machine resting on top of the plate keeps the resistance device stable while in use. Additional brackets or clamps 2340 may also be used, if desired, and may take any form known in the art. It should be noted that the use of clips 1940 at the end of connectors 2400 (as illustrated in Fig. 19) allows handgrips 1900 to be used when the plate is being used in connection with a lower body exercise machine, and then interchanged with handle-type grips 2330 for a workout without a lower body exercise machine wherein the user stands directly on the plate as depicted in Fig. 6D.

As previously noted, any type of resistance device may be used with respect to any of the embodiments discussed above, as is illustrated by the use of reel 12 in Fig. 6D and module 1800 in Fig. 5K, with no limitation to even these particular resistance module types.

EXERCISE METHODOLOGY AND RESULTS

Some of the advantages of the various combinations discussed herein may be particularly well understood with respect to the unique method of exercise engendered by the use of an upper-body exercise device in conjunction with a treadmill as claimed herein. The use of such a combination essentially turns a walking exercise on a treadmill into an exercise having the metabolic equivalent of a run, without the impact associated with running. A walker on a treadmill outfitted with rear-mounted arm resistance devices providing resistance to a full natural arm swing of the user tends to adopt a longer, lower, slower stride with the knees more bent than the normal walking stride of the user. The arm resistance not only exercises the user's arms, but also causes the user to push off harder with the legs, thereby increasing the involvement of the hip, thigh, calf, and buttocks muscles in the exercise as the lower body counteracts the resistance applied to the upper body. The inventor has found that the synergistic and unexpected effect of such a workout is that a walker on a treadmill using 1.5 lbs. of resistance on the upper-body resistance devices and engaging in a walk at 3.3 mph, experiences a workout equivalent to that of a 6 to 7 mph run, or 62% increase in the metabolic workout.

On any type of lower body exercise machine, use of an upper body exercise module as described in the present invention causes the user to adopt a slower pace and take deeper, more rhythmic breaths as compared to the user using the lower body exercise machine without simultaneously using the upper body exercise device. The slower pace may be particularly beneficial for maximizing the aerobic workout without having to adopt an overly vigorous exercise rate that may be undesirable for some individuals. For example, instead of having to vigorously pedal a bicycle to get a certain degree of workout, a user may instead develop a slower

pedaling pace while using the upper body resistance modules as described herein to provide an overall workout that is just as effective.

The combination of the lower body exercise machine, upper body resistance devices placed such that the vector of resistance for each device is behind and to the side of the user, and loose-grip user engagement that is resistant to hand cramps and elevated blood pressure of the user while still safely allowing quick disengagement from the user's hands, therefore represents not only a unique exercise device, but also promotes a unique method of exercising as well.

The use of resistance behind the user increases the workout as compared to walking with weights, because weights tend to have a pendulum effect on the arms of the user, allowing gravity to assist in pulling the arms downward in the early part of a forward swing, whereas a rear-mounted resistance device, for example, provides resistance throughout the entire forward swing.

Although various embodiments of the invention have been described, it will be understood that the invention is not limited to these embodiments, but is capable of numerous modifications of parts, elements and materials without departing from the invention.